8 Input Requirements and Program Output for SAM.sed

Purpose

SAM.sed calculates sediment discharge rating curves for the bed material load using sediment transport functions. The input and output vary only insofar as different functions are selected. This chapter will address the input data requirements and discuss the associated output.

General

The SAM.sed module expects an input file designated as *xxxxxxxx*.**si***x*, where *x* can be any DOS acceptable character, including a space (but no embedded spaces), i.e., acceptable file names could be *say.si* or *ITSNEVER.SIS*. SAM.sed will write a corresponding file *xxxxxxxx*.**so***x*, which is the sediment transport calculation's output file; and a *xxxxxxxx*..**yi***x* file which may be used as an input file to SAM.yld.

SAM.hyd will create a ".si" file. The ".si" file can also be created manually by using either PSAM, an editor, or SAM.m95 in combination with a TAPE95 from an HEC-2 execution. In some cases, modifications to the SAM.hyd-created ".si" file may be necessary before sediment transport calculations can be made.

SAM.aid is an option in the SAM package that can provide guidance in the selection of sediment transport functions. It uses any ".si" file.

The sample data sets used in the input and output discussions are those provided with the SAM package in the SEDPC.LIB files and are printed out in Appendix J.

Program execution

SAM.sed is accessed from the SAM Main Menu where it appears as option 2. Since SAM.sed utilizes both the automatic filename transfer and the default filenames, described in Appendix F, calculations will usually begin immediately upon triggering the SAM.sed option. If no files are accessible in this manner, the following message will print to the screen (SAM.IN is the default filename for all three modules):

```
       Msg 1: SED. READING INPUT DATA FROM FILE [  sam.in        ]
THIS DIRECTORY.

       Msg 2: SED.main >>Data File [   sam.in        ]  Does Not
Exist.


       SAM.sed.main   Options:
       ENd   HElp   RUn   ATach [inputfile]   SAve [inputfile]
```

At this point two options allow execution, at [*filename*] or ru [*filename*]. The ru command will attach and run the specified file. The at command will simply attach the specified file. If the file exists, SAM.sed will respond with

```
       SEDIMENT INPUT file = filename           PRINTOUT TO file =
filename
       YIELD INPUT file = filename            PRINTOUT TO file =
filename

     Msg 1: SED. READING INPUT DATA FROM FILE [  filename  ] THIS
DIRECTORY.

     SAM.sed.main Options:
     ENd   HElp    RUn    ATtach [inputfile]    SAve [inputfile]
```

Next type the ru command to complete execution.

If the file does not exist, both Msg 2 and the SAM.sed.main menu will appear, regardless of which command had been typed. The next step is to attach or run a different file.

When SAM.sed has found the file it was expecting, default or other, it will "OPEN" that input data file, and execution will follow automatically. Selective - output will scroll to the screen. All output will be saved in the default output filename, which the user cannot alter, and can be inspected with LIST, COED, or a system editor. When the computations are finished, the following will be on the screen:

```
END OF JOB       PRINTOUT SAVED IN FILE  [ default filename ]

SAM.sed.main   Options:
ENd   HElp   RUn   ATtach[inputfile]   SAve[inputfile]
```

At this point there are two options. The run can be ended by typing end, and the complete output can be inspected using LIST or COED, both on the SAM menu. The second alternative is to execute the at or run command again, perhaps on a different file. If a different filename is chosen, output

will go to that filename's corresponding default output file.

NOTE: The at command can be left out. The ru command will both attach and run the specified file.

Sample Input Data

The input data file can be prepared with a system editor, with PSAM, by the hydraulics calculations in SAM.hyd, or by SAM.m95 which reads the HEC-2 output, TAPE95. Of these, however, only SAM.hyd provides the "effective" value for sediment transport variables. If channel and overbanks are specified in the SAM.hyd file, only the channel variables are transferred to the ".si" file. The discharge is the total discharge and is used only as an identifier and not used in the calculations. SAM.m95 uses channel hydraulic radius for Effective Depth, channel water surface width for Effective Width, and channel velocity for Effective Velocity.

The following example shows input data as created by running TEST 1C in SAM.hyd. Notice that only the Laursen(Madden) function shows "YES." PSAM, or COED can be used to select other transport functions for computation. The SAM.hyd input file from which this file was developed contained a PF-record so this required record is already in the file. If the record were not in the SAM.sed input file, it could be added through the use of PSAM or an editor. If the record were not in the file when SAM.sed is executed, the program will prompt for that data.

```
TI      FILE WRITTEN BY SAM.hyd
TF TOFFALETI.            NO
TF YANG.                 NO
TF EINSTEIN(TOTAL-LOAD)  NO
TF ACKERS-WHITE.         NO
TF COLBY                 NO
TF TOFFALETI-SCHOKLITSC  NO
TF MPM(1948).            NO
TF BROWNLIE,D50          NO
TF TOFFALETI-MPM         NO
TF LAURSEN(MADDEN),1985 YES
TF LAURSEN(COPELAND)     NO
TF YANG,D50              NO
TF ACKERS-WHITE,D50      NO
TF MPM(1948),D50         NO
TF PARKER                NO
TF EINSTEIN(BED-LOAD)    NO
TF PROFITT(SUTHERLAND)   NO
TF ENGELUND-HANSEN       NO
TF SCHOKLITSCH           NO
TF VAN.RIJN              NO
VE  1.29    2.77    5.41    7.41   10.14
DE  0.76    3.23    7.23    9.71   13.28
WI  103.   111.7   127.9   138.8   148.5
QW   100    1000    5000   10000   20000

ES521E-6

WT    50
```

```
PF                              1      .8      98     .48      50     .25
   16
$$END
```

Sample Output Data

Selected results are printed to the screen as the program executes. The printout is also saved in the default output file. Also, the sediment transport rating curve - needed for the sediment yield calculations is written into the default SAM.yld file.

Output Data Sets

The following output description refers to the output of Test 1C listed above. The Ackers-White,D50, and the Van Rijn functions have been selected in order to point out certain associated output.

```
*****************************************************
*                                                   *
*     HYDRAULIC DESIGN PACKAGE FOR FLOOD CONTROL    *
*                    CHANNELS (SAM)                 *
*                                                   *
*          SEDIMENT TRANSPORT CALCULATIONS          *
*                                                   *
* VERSION 3.1                      5 SEPTEMBER 1996 *
*                                                   *
*                  A Product of the                 *
*     Flood Control Channels Research Program       *
*Hydraulics Laboratory, Waterways Experiment Station*
*****************************************************

 Msg 1:  SED. READING INPUT DATA FROM FILE [  t1C.si  ] THIS DIRECTORY.


 TABLE  1.  LIST INPUT DATA.

 TI      FILE WRITTEN BY SAM.hyd

 TF TOFFALETI.            NO

 TF YANG.                 NO

 TF EINSTEIN(TOTAL-LOAD)  NO

 TF ACKERS-WHITE.         NO

 TF COLBY                 NO

 TF TOFFALETI-SCHOKLITSC  NO

 TF MPM(1948).            NO

 TF BROWNLIE,D50          NO

 TF TOFFALETI-MPM         NO

 TF LAURSEN(MADDEN),1985 YES
```

```
 TF LAURSEN(COPELAND)     NO

 TF YANG,D50              NO

 TF ACKERS-WHITE,D50     YES

 TF MPM(1948),D50         NO

 TF PARKER                NO

 TF EINSTEIN(BED-LOAD)    NO

 TF PROFITT(SUTHERLAND)   NO

 TF ENGELUND-HANSEN       NO

 TF SCHOKLITSCH           NO

 TF VAN.RIJN             YES

 F# 45678 2345678 2345678 2345678 2345678 2345678 2345678 2345678 2345678
2345678
 VE  1.29    2.77    5.41    7.41   10.14

 DE  0.76    3.23    7.23    9.71   13.28

 WI  103.   111.7   127.9   138.8   148.5

 QW   100    1000    5000   10000   20000

 ES521E-6

 WT    50

 PF                            1      .8      98     .48      50     .25
    16
 $$END

1


 BED SEDIMENT FRACTIONS CALCULATED FROM PF-DATA.

   NO     PERCENT   PARTICLE   INCREMENTAL
           FINER      SIZE       FRACTION
      |      %    |    mm     |            |
 _____|___________|___________|____________|

    8 |    16.000 |    0.2500 |            |
      |           |           |  0.3783586 |
    9 |    53.836 |    0.5000 |            |
      |           |           |  0.4616414 |
   10 |   100.000 |    1.0000 |            |


    TABLE  3.  PROPERTIES OF THE WATER

  #  TEMP     RHO    VISCOSITY  UNIT WT
     DEG F  #-S/FT4    SF/SEC    WATER
                                 #/FT3

  1   50.0    1.940      1.411   62.411
  2   50.0    1.940      1.411   62.411
  3   50.0    1.940      1.411   62.411
  4   50.0    1.940      1.411   62.411
  5   50.
0    1.940      1.411   62.411


         TABLE 2.1.    HYDRAULIC PARAMETERS
```

N	TOTAL DISCHARGE CFS	EFFECTIVE DISCHARGE CFS	EFFECTIVE VELOCITY FPS	EFFECTIVE DEPTH FT	EFFECTIVE WIDTH FT	ENERGY SLOPE FT/FT
1	100.	101.	1.29	0.76	103.00	0.0005210
2	1000.	999.	2.77	3.23	111.70	0.0005210
3	5000.	5003.	5.41	7.23	127.90	0.0005210
4	10000.	9987.	7.41	9.71	138.80	0.0005210
5	20000.	19997.	10.14	13.28	148.50	0.0005210

TABLE 4.1 LAURSEN(MADDEN),1985 METHOD = NO. 13

SIZE CLASS no	GRAIN SIZE mm	PERCENT IN CLASS %	SEDIMENT TRANSPORT POTENTIAL TONS/DAY	SEDIMENT TRANSPORT CAPACITY TONS/DAY	SEDIMENT TRANSPORT CONC PPM
8	0.354	37.84	6.59333	2.49464	9.2394
9	0.707	46.16	0.100000E-06	0.461641E-07	0.17098E-06
Q, CFS = 100.000			QS, TOTAL =	2.49464	9.2394

TABLE 4.1 LAURSEN(MADDEN),1985 METHOD = NO. 13

SIZE CLASS no	GRAIN SIZE mm	PERCENT IN CLASS %	SEDIMENT TRANSPORT POTENTIAL TONS/DAY	SEDIMENT TRANSPORT CAPACITY TONS/DAY	SEDIMENT TRANSPORT CONC PPM
8	0.354	37.84	333.654	126.241	46.756
9	0.707	46.16	53.7169	24.7979	9.1844
Q, CFS = 1000.00			QS, TOTAL =	151.039	55.940

TABLE 4.1 ACKERS-WHITE,D50 METHOD = NO. 16

SIZE CLASS no	GRAIN SIZE mm	PERCENT IN CLASS %	SEDIMENT TRANSPORT POTENTIAL TONS/DAY	SEDIMENT TRANSPORT CAPACITY TONS/DAY	SEDIMENT TRANSPORT CONC PPM
1	0.466	100.00	9248.63	9248.63	685.08
Q, CFS = 5000.00			QS, TOTAL =	9248.63	685.08

TABLE 4.1 ACKERS-WHITE,D50 METHOD = NO. 16

SIZE CLASS no	GRAIN SIZE mm	PERCENT IN CLASS %	SEDIMENT TRANSPORT POTENTIAL TONS/DAY	SEDIMENT TRANSPORT CAPACITY TONS/DAY	SEDIMENT TRANSPORT CONC PPM
1	0.466	100.00	29069.5	29069.5	1076.6
Q, CFS = 10000.0			QS, TOTAL =	29069.5	1076.6

VANRIJN -- CONCENTRATION PROFILE BY SIZE CLASS IN MG/L

SD(I)MM	REF CONC	Y/D=.1	Y/D=.2	Y/D=.3	Y/D=.5	Y/D=.7	Y/D=1.0
0.35367	24668.2	1946.9	824.9	466.1	0.0	81.5	22.9
0.70734	24119.0	139.9	24.5	7.7	0.0	0.2	0.0
TOTAL	48787.2	2086.8	849.4	473.8	0.0	81.7	22.9

```
            TABLE 4.1   VAN.RIJN             METHOD = NO. 23

 SIZE     GRAIN    PERCENT   ---------SEDIMENT TRANSPORT----------
 CLASS     SIZE   IN CLASS   POTENTIAL    CAPACITY      CONC
  no        mm        %       TONS/DAY    TONS/DAY       PPM
    8      0.354    37.84    60790.4      23000.6      851.87
    9      0.707    46.16    22139.1      10220.3      378.53
                                          ___________ ___________
 Q, CFS =  10000.0          QS, TOTAL =   33220.9      1230.4

            VANRIJN -- CONCENTRATION PROFILE BY SIZE CLASS IN MG/L

    SD(I)MM   REF CONC   Y/D=.1   Y/D=.2   Y/D=.3   Y/D=.5   Y/D=.7
Y/D=1.0

    0.35367    42628.9   3656.2   1593.3    917.4      0.0    169.7
49.7
    0.70734    42082.9    427.5     90.5     32.3      0.0      1.4
0.1

    TOTAL      84711.9   4083.7   1683.9    949.6      0.0    171.1
49.8



            TABLE 4.1   VAN.RIJN             METHOD = NO. 23

 SIZE     GRAIN    PERCENT   ---------SEDIMENT TRANSPORT----------
 CLASS     SIZE   IN CLASS   POTENTIAL    CAPACITY      CONC
  no        mm        %       TONS/DAY    TONS/DAY       PPM
    8      0.354    37.84    226726.      85783.8      1588.6
    9      0.707    46.16    85380.5      39415.2      729.91
                                          ___________ ___________
 Q, CFS =  20000.0          QS, TOTAL =   125199.      2318.5


 TABLE 5.0  SUMMARY TABLE:   BED-MATERIAL SEDIMENT DISCHARGE, TONS/DAY

  Q |    WATER    |      TRANSPORT FUNCTIONS
 NO |  DISCHARGE  |    LAURSEN  |   ACKERS-   |   VAN.RIJN  |
                   (MADDEN), 85| WHITE, D50  |             |
  1 |       100.00|         2.49|         6.75|         5.50|
  2 |      1000.00|       151.04|       647.18|       288.48|
  3 |      5000.00|      3284.00|      9248.63|      8690.65|
  4 |     10000.00|      9798.54|     29069.52|     33220.91|
  5 |     20000.00|     27711.13|     87293.54|    125199.00|

 End of Job     PRINTOUT SAVED IN FILE t1C.so
```

Output Data Description

Table 1 echoes the input data file. An un-numbered table lists the "Bed Sediment Fractions Calculated From PF-Data." In Table 3 the properties of water are calculated from the water temperature at sea-level. The hydraulic parameters from input data are listed in Table 2.1. Effective discharge is the product of the width, depth, and velocity and represents channel discharge. Table 4.1 presents detailed results of the sediment transport calculations, in rows by sediment size

class and in columns as labeled. Notice the discharges are the total discharges from the QW-record. Concentration is calculated using total discharge, not channel discharge. There is a separate Table 4.1 for each water discharge listed. There will also be a separate Table 4.1 for each sediment transport function selected in the input file. Only two discharges' output for each function is shown here. The Van Rijn function provides additional printout. For each water discharge the sediment concentration profile by size class is calculated, in mg/l. Table 5 is a summary of the calculated total bed-material sediment discharge, in rows according to water discharge and in columns by sediment transport function. This is the table that echoes to the screen at run time.

Sample of Data Written to SAM.yld Input File

SAM.sed writes the sediment concentration rating curve calculated for each sediment transport function selected to the SAM.yld input file, as shown below.

```
TI      FILE WRITTEN BY SAM.sed
TI     LAURSEN(MADDEN),1985
QW   100    1000    5000   10000   20000

SC 9.239  55.940    243.    363.    513.

$JOB
TI      FILE WRITTEN BY SAM.sed
TI     ACKERS-WHITE,D50
QW   100    1000    5000   10000   20000

SC25.006    240.    685.   1077.   1617.

$JOB
TI      FILE WRITTEN BY SAM.sed
TI     VAN.RIJN
QW   100    1000    5000   10000   20000

SC20.354    107.    644.   1230.   2319.

$$END
```

A separate sediment concentration rating curve is written for each sediment transport function selected in SAM.sed. If there is only one discharge in the SAM.sed input file, no SAM.yld input file is written, and a message to that effect appears on the screen.

Plotting

SAM.sed has no plotting capability. It writes a HECDSS input file to TAPE97 which is automatically read by a HECDSS utility upon exiting SAM.sed. Plotting is done by executing the HECDSS program from the main SAM menu. Plotting from HECDSS is described in detail in "HECDSS -- User's Guide and Utility Program Manuals" (USACE, 1990). However, the steps required to view and print a plot will be briefly described here.

After choosing the plot option from the SAM main menu, type

CA.AN to catalog the available plot files and display the listing on the screen.

Each plot available will echo the SAM.sed default DSS "pathname" or the one input by the user on a ZW-record. Each will also be listed with both a "Ref. Number" and a "TAG" as shown in the next figure.

```
  Ref.
 1   T1      //LAURSEN(MADDEN),1985/FLOW - LOAD////
 2   T3      //ACKERS-WHITE,D50/FLOW - LOAD////
 3   T2      //VAN.RIJN/FLOW - LOAD////
 4   T4      /TEST 1A/LAURSEN(MADDEN),1985/FLOW -
LOAD////
 5   T6      /TEST 1A/ACKERS-WHITE,D50/FLOW - LOAD////
 6   T5      /TEST 1A/VAN.RIJN/FLOW - LOAD////
```

Up to seven lines can be plotted on one screen. Use either the "Ref. Number" or the "TAG" to specify which "pathname(s)" to plot. Sediment discharge rating curves are typically plotted on log log paper. Type

AX LOG LOG will set the axes to the log log mode.

PL 1 [**2 4 5**] to plot these to the screen, the part within the brackets being optional, i.e., showing the command for plotting more than one line. There can be spaces or commas between the items to be plotted.

To make the plot print, type

DEV PR which tells DSS to send the next plot(s) to the printer. However, to actually get a plot, the PL command must be repeated. To reactivate the screen as the plot-receiving device, type

DEV SC

There are many options in the DSS program. Refer to the HECDSS manual for these.

To exit the plot module and return to the SAM main menu, type

FI

NOTE: If zero sediment transport is calculated for one of the discharges for any transport function, then that function will not plot on the log log axes. The TAPE97 can be modified, however. This file, TAPE97, must be renamed prior to exiting the SAM main menu; otherwise it will be erased. With a system editor the data pair(s)

containing zeros can be deleted and the file saved. The next command to be typed in, at the DOS prompt is

DSSPD input=*filename* output=*junkname*

where *filename* is the new name given to the TAPE97 file and *junkname* is any name; usually it is never necessary to look at this file. This procedure will create a HYD.DSS which can then be plotted using the PLOT option on the SAM main menu.